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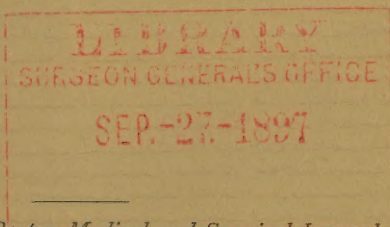
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THE INFLUENCE OF ANESTHESIA UPON  
MEDICAL SCIENCE

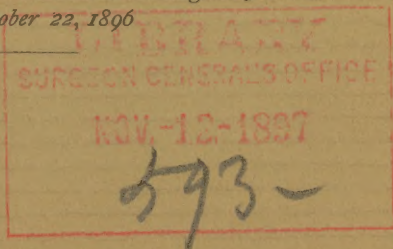
BY

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BALTIMORE



*Reprinted from the Boston Medical and Surgical Journal  
of October 22, 1896*



BOSTON

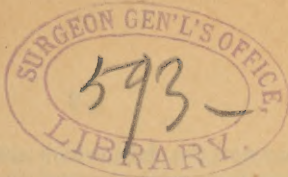
DAMRELL & UPHAM, PUBLISHERS

283 WASHINGTON STREET

1896

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S. J. PARKHILL & CO., PRINTERS  
BOSTON



## THE INFLUENCE OF ANESTHESIA UPON MEDICAL SCIENCE.<sup>1</sup>

BY WILLIAM H. WELCH, M.D., BALTIMORE.

*Mr. President, Gentlemen of the Board of Trustees and of the Medical Staff of the Massachusetts General Hospital, Ladies and Gentlemen:*—Five months ago was celebrated the centennial anniversary of that grand discovery by Jenner which brought under subjection the most prevalent and horrible scourge of former centuries. To-day we have assembled in this famous hospital on the very spot, made memorable for all time, where fifty years ago William Morton first demonstrated to the world the art of surgical anesthesia, the happiest gift ever conferred upon mankind by medical science or art. We may add to vaccination and anesthesia the more recent introduction of antiseptics by Lister; and we can truthfully say that all the previous centuries can show no achievement of the art of the physician or surgeon comparable in beneficence to any one of these triumphs of the last hundred years.

It is in consequence of their enduring utility and benefit to humanity that these discoveries, which have led to the mastery over a pestilence, the annulment of pain and the safe healing of wounds, merit the everlasting gratitude of the world. But it is fitting on such a commemorative occasion as this, that, while these practical aspects receive their due consideration, we forget not the debt which these great discoveries owe

<sup>1</sup> Remarks made October 16, 1896, at the Commemoration of the Fiftieth Anniversary of the First Public Demonstration of Surgical Anesthesia at the Massachusetts General Hospital, Boston.

to science nor the debt which science owes to them. It is, therefore, most appropriate that those who arranged the programme to commemorate this fiftieth anniversary of the first public demonstration of surgical anesthesia should have chosen as one of the themes to be here presented, "The Influence of Anesthesia upon Medical Science." Their wisdom I am sure was less conspicuously manifested in their selection of the medium for the presentation of this subject, highly as I esteem the honor of being invited to speak upon this occasion.

In the limited time allotted to an individual speaker I cannot hope to do more than to present in outline some of the salient aspects of my theme.

I shall not attempt to trace the history of the discovery of surgical anesthesia, a history which affords a lamentable illustration of how the awards of generous gratitude may be sacrificed to fruitless efforts to mete out equal and exact justice. I wish in this connection to call attention only to the fact that this discovery was made in the only way in which it possibly could have been made, and that is by the method of experimentation. The opponents of animal experimentation have endeavored to utilize for their purposes the alleged absence of experiments upon animals as the basis of this discovery. As a matter of fact, even leaving out of account the pioneer experiments upon animals by Humphry Davy with nitrous oxide, the first successful trial of ether as a general anesthetic for human beings by Morton was preceded by his demonstration of the power of this agent to produce in dogs unconsciousness and insensibility to pain. It would be strange, indeed, if these striking results of experiments upon animals had no influence in inducing him to test their applicability to human beings.

It must, however, be admitted that the production



of anesthesia in man by inhalation of ether was not preceded by such numerous and properly conducted experiments on animals as were required to afford any adequate conception of its effects or its possibilities of danger. We now know that such experiments would have yielded knowledge of this character. We know also that the anesthetic sleep induced by ether in man as well as in animals is not attended with more than a minimal amount of danger; but suitable experiments upon animals would have afforded more knowledge than Morton could have possessed as to whether there was to be sure awakening from that sleep so like unto death. Hence it is that when that patient fifty years ago to-day in this hospital was placed under the profound influence of ether he was made the subject of a scientific experiment of immense practical import and of unsurpassed boldness. This was the decisive experiment from which dates "the continuous and consequent history" of anesthesia.

The discovery of surgical anesthesia is, I repeat, a triumph of the experimental method, albeit man himself was made the subject of experiment and thereby exposed to unknown possibilities of danger.

If my theme embraced the consideration of all of the relations of artificial anesthesia to medical science, and did time permit, it would be proper for me to direct attention to the part played by animal experimentation in the discovery and introduction of new anesthetics and to the numerous physiological and pharmacological experiments, mainly upon animals, which have shed so much light upon the mode of action of anesthetics, particularly of ether and chloroform, and the sources of danger in their employment. Although not all of the questions involved have yet been solved, these experiments have furnished a large

amount of knowledge of great scientific value and of much practical interest concerning the properties of anesthetics, knowledge which it is certainly desirable to possess and much of which could not have been gained otherwise than by experiments upon animals.

I might speak also of the broad biological interest which attaches to the universal susceptibility of living matter to the sleep-producing influence of ether and chloroform, a susceptibility extending even to vegetable cells and the simplest unicellular organisms, also of how the gentle killing of certain bacteria by chloroform enables us to detect in their bodies toxic substances which are destroyed by more violent modes of death, and further of interesting properties of nerve and of muscle which have been revealed by studying under various conditions the action upon them of anesthetic agents. But I do not interpret the subject assigned to me as including the consideration of such matters as these, interesting as they are, and it is certain that time would not permit even their sketchy presentation upon this occasion.

What I especially desire to emphasize in these brief remarks is that the utility of the discovery of anesthetics is not limited to their practical application to the surgical and medical and obstetrical arts, but that this discovery has been of great service also to medical science upon which these arts in large part rest.

Anesthetics appeared upon the scene at a time when the experimental medical sciences were entering upon an epoch of activity and success far surpassing anything previously known in the history of medicine. The shackles of philosophical speculation and dogma which bound medicine at the opening of this century had been broken by the work of such men as Bichat, Magendie, Johannes Müller, Rokitansky, Laennec and Louis. Their work was based upon exact observa-

tion and experiment, and there had come to be a general realization of the fact that these are the only trustworthy sources of knowledge. Animal experimentation, which, as a fruitful method of investigation, began with Harvey's discovery of the circulation of the blood, had in the hands of Charles Bell, Magendie, Müller and others yielded abundant proofs of its value. It was during the fourth decade of this century that those great experimenters, Claude Bernard, from the school of Magendie, and Du Bois-Reymond, Helmholtz, Brücke and Ludwig, from the school of Müller, started their epochal investigations in physiology. It was at the same period that Virchow and Traube began those researches which established animal experimentation, already successfully employed by John Hunter, as a most important aid in the development of pathological physiology. It was then also that experimental pharmacology, which had been inaugurated by Magendie, was first cultivated as a distinct branch of medical science by Buchheim. The need of suitably equipped laboratories where experimental investigations could be conducted was now felt more keenly than ever before. By being the first to supply these essential instruments of fruitful scientific activity, Germany took the lead in scientific discovery, a position which her enlightened policy in the establishment and support of laboratories has enabled her ever since to retain.

The introduction of artificial anesthesia came at this auspicious period of awakened activity, which gave such promise of the rapid development of scientific medicine through the aid of exact observation and experiment. And how brilliantly has this early promise been fulfilled by the discoveries of the last fifty years which have witnessed the creation of cellular pathology, the rapid development of physiology to a



biological science of the first rank, conferring great benefits upon medicine but extending far beyond the boundaries of medicine, the establishment of pharmacology upon a broad scientific basis, and the birth of the science of bacteriology which has unlocked the gates to new fields whose brief exploration has already proven of such immense importance to preventive and curative medicine and practical surgery! It is true that, when we consider all that we may reasonably hope to learn concerning the structure and functions of living beings in health and in disease and how they may be influenced for good or for ill, only a corner of the curtain has been lifted, but when we compare the advance of medicine during the last fifty years with what was previously known, we can truthfully say that this advance has been greater during these years than during all the previous centuries.

A large and important part of this progress is attributable to the results obtained by means of experiments upon animals. One has only to imagine blotted out from the records of physiology, pathology, pharmacology, hygiene, bacteriology and other medical writings all of the facts which have been derived from animal experimentation to realize how immense would be the loss to both scientific and practical medicine, had investigators been deprived of this indispensable method of research. To point out in detail how broad and deep would be this gap cannot be even attempted in the short time here allotted, and would be surely unnecessary before this audience.

The use of anesthetics has been such an important aid in the performance of these experiments upon animals during the past fifty years that it is eminently fitting on this jubilee that medical science should also pay its tribute to the beneficence of the great discovery here celebrated.



The ways in which anesthetics have been serviceable to animal experimentation are essentially similar to those in which they have benefited surgery.

The great majority of painful vivisectional experiments upon the higher animals are of such a nature that the object of the experiment is not defeated by the employment of anesthetics. In experiments of this class all trained experimenters should and do use anesthetics, and there is no evidence that there exists to-day any abuse of vivisection on this score in any properly conducted laboratory. The dictates of humanity demand that we shall gain for the benefit of man knowledge which can be acquired only from experiments upon animals, and they demand also that this knowledge shall be gained without the infliction of needless suffering. Humane instincts are not less active among those who devote themselves to acquiring knowledge in this way than among other classes of men, but these instincts in the former are controlled not by false sentiment but by reason and duty. It is a source of immense gratification to experimenters, as it should be to all with humane impulses, that in consequence of the discovery of artificial anesthesia so large a part of the useful knowledge which can be derived only from experiments upon animals can now be acquired without the infliction of pain. To cite the animal experiments of pre-anesthetic days, as for example those of Magendie, as illustrations of present methods of experimentation, is as unwarrantable as would be a similar procedure in describing surgical operations.

The advantages of anesthesia are not limited by the mere abolition of pain. In animal experimentation as well as in surgery the insensibility to pain and the cessation of voluntary movements induced by anesthetics have rendered many operations easy which

would otherwise have been difficult, many practicable, which would otherwise have been impossible. The success of the experiment is made much more certain when the operator can work at ease and without undue haste, undisturbed by the thought that he is inflicting pain. There are physiological experiments which, so far as I am able to judge, make greater demands upon the patience and operative skill and delicacy of manipulation of the operator than any in surgery, and these never could be performed upon a sensitive and struggling animal. Sensations of pain are in themselves a disturbing factor which would defeat the purpose of not a few delicate physiological experiments. The experiments to determine the functions of the brain, which have yielded results of great importance to practical medicine and surgery as well as to science, may be mentioned as one out of many illustrations of this fact. The antiseptic management of wounds, which is essential to the success of some experiments and which alleviates subsequent suffering when it is necessary that the animal should survive the experiment, is greatly facilitated by the use of anesthetics.

I trust that I may be pardoned if I pause here for a moment to correct a misconception which does not exist among well-informed medical men, least of all among practitioners of medicine, but which plays a considerable rôle in antivivisection literature. I refer to the distinction there made between the use of anesthetics and that of narcotics for the purpose of rendering animals insensible to pain. So far as the point in question is involved this distinction is ridiculous, and seems to be based upon a misunderstanding of some old physiological experiments. For prolonged experiments it is often advantageous to place the animal in the sleep induced by morphine or chloral instead of that of ether or chloroform. These drugs are admin-

istered in much larger doses, and often in different ways, than is customary in human beings. That under these circumstances the animal is rendered insensible to pain is a fact, the knowledge of which might have been gained from ordinary medical experience.

Curara is a drug which has important uses in a certain class of experiments upon animals. It has never been claimed by any scientific man that it is an anesthetic, although it has been found capable of affording great relief from pain in some spasmodic affections of human beings. Its use has led to important physiological discoveries which could not well have been made without it, and in a limited class of cases its employment, either with or without the coincident administration of anesthetics, is indispensable.

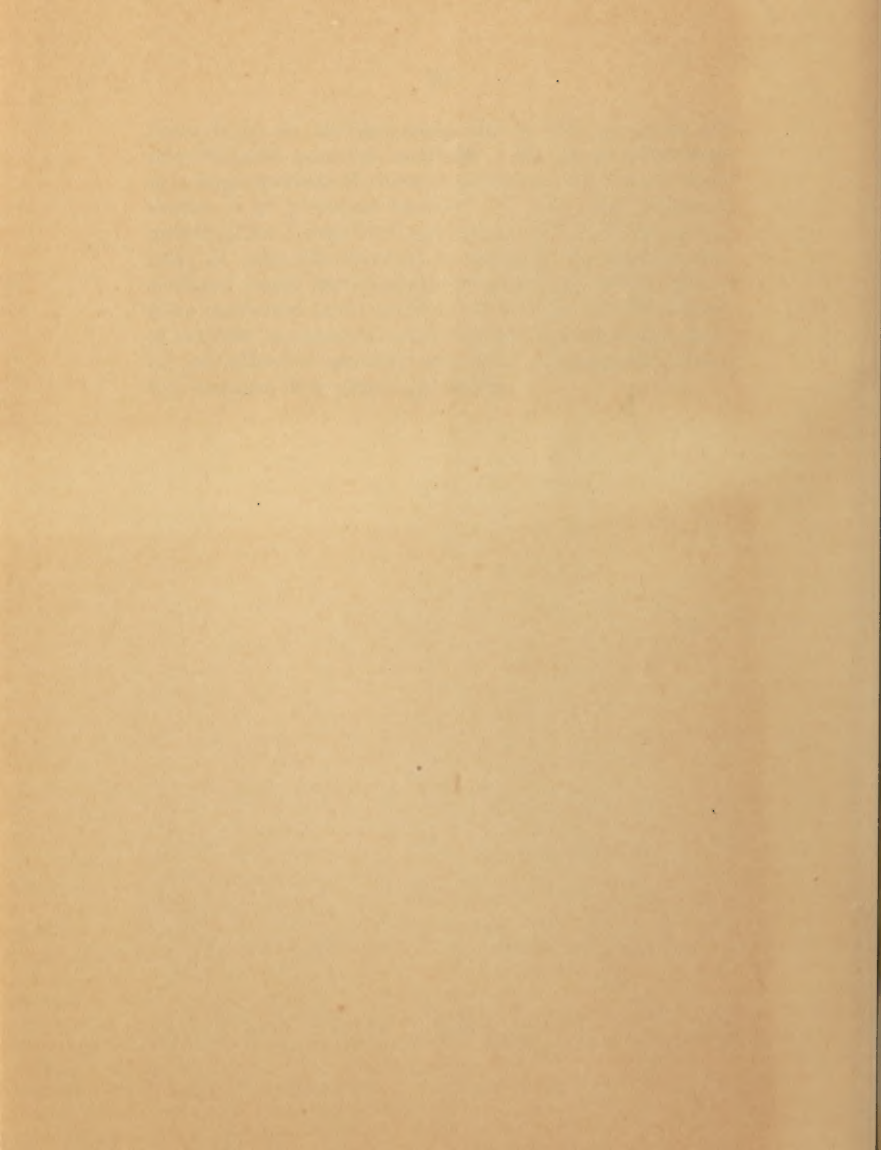
There are, of course, experiments upon animals in which there is no occasion to employ anesthetics. Animal experimentation and vivisection are not co-extensive terms. There is a large group of experiments, mostly of a painless character, in which there is no cutting or other operative interference whatever with the animal. Here belong many of the experiments upon metabolism, upon diet, upon the fate of drugs, etc. There are others in which the operative act is so slight or transitory that the animal would suffer far more discomfort from the administration of an anesthetic than from the operation itself. There are, finally, painful vivisection experiments, relatively few in number however, whose purpose would be defeated by the use of anesthetics. A striking example of such an experiment is that of Charles Bell in determining the motor and sensory functions of the nerve roots of the spinal cord, an experiment which, with those of Galvani, laid the foundations of modern nerve physiology.

Experiments upon animals have been and must con-

tinue to be an indispensable aid to the progress of scientific and practical medicine. In the performance of a large number of these experiments the use of anesthetics is of priceless service. I trust that without presumption I may here express in behalf of the great body of scientific workers in medicine throughout the civilized world their feelings of gratitude for the great boon conferred upon medical science by the discovery of artificial anesthesia, which in the form of a safe, useful and effective method, was first promulgated from this hospital fifty years ago to-day.







— THE BOSTON —  
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PUBLISHED BY DAMRELL & UPHAM,  
233 Washington St., Boston.

